Sample Exam 4 **Math 208** **Fall 2009**

Name:______________________________ **Score:**___________

Instructions: Show your work in the spaces provided below for full credit. Use the reverse side for additional space, *but clearly so indicate.* You must clearly identify answers and show supporting work to receive any credit. Exact answers (e.g., π) are preferred to inexact (e.g., 3.14). Make all obvious simplifications, e.g., 0 rather than $\sin\pi$. Point values of problems are given in parentheses. Point values of problems are given in parentheses. Notes or text in *any* form not allowed. The only electronic equipment allowed is a calculator.

---

(28) **1.** Let S be the portion of the cone $z = 2\sqrt{x^2 + y^2}$ between the planes $z = 2$ and $z = 4$ and vector field $\mathbf{F} = \langle 0, -x, z \rangle$.

(a) Determine whether or not the vector field $\mathbf{F}$ is conservative.

(b) Find a parametrization of S and express $\mathbf{r}$ (position vector) and $\mathbf{F}$ in terms of it.

(c) Set up (do not solve) an iterated integral for $\displaystyle\iint_S \mathbf{F} \cdot \mathbf{n}\, d\sigma$, where $\mathbf{n}$ is the upward pointing normal.

(16) **2.** Find a potential function for the vector field $\mathbf{F}(x, y) = \langle x - 5, 3y^2 + 7 \rangle$.

(20) **3.** Use Green's Theorem to evaluate $\oint_C \left(e^{x^2} - 2y\right) dx + \left(e^{y^2} + 4x\right) dy$, where C is the circle $x^2 + y^2 = 4$, oriented counterclockwise.

(18) **4.** Use Stokes' Theorem to express the flux integral $\int\int_S \nabla \times (y\mathbf{i}) \cdot \mathbf{n}\, d\sigma$ as a definite integral (do not solve it), where S is the portion of the paraboloid $z = 1 - x^2 - y^2$above the xy-plane with outward pointing normal $\mathbf{n}$.

(18) **5.** Use the Divergence Theorem to evaluate $\int\int_S \mathbf{F} \cdot \mathbf{n}\, d\sigma$, where $\mathbf{F} = \langle y^3 - 2x, e^{xz}, 4z\rangle$ and S is the boundary of the rectangular box $0 \leq x \leq 2$, $1 \leq y \leq 2$, $-1 \leq z \leq 2$, with exterior unit normal.